OBSERVATIONS ON SOME AUSTRALIAN *POLYCHÆTA*.

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Part I.

[With Plates L.—LV.]

I. SYLLIDÆ.

Kinberg (1) has described two species of this family (*Thoë fusiformis* and *Eurymedusa picta*) obtained in Port Jackson during the voyage of the "Eugènie." These are, as far as I am aware, the only species of *Syllidæ* that have been described from the Australian coast. I have not been able to obtain access to the more detailed descriptions of these Annelids given in the "Annulata" of the "Eugenies Resa," (the two copies of that work which I have had the opportunity of examining being both incomplete), but by a careful analysis of the short definitions in the preliminary paper above referred to I have convinced myself that the species in question are both distinct from any of the six described in the present memoir.

Of these six species one (*Syllis corruscans*), is very remarkable in several respects, and most especially in the presence in the section of its alimentary canal which I here call the gizzard, of striated muscular tissue of a very marked type—a tissue which has never before been described as occurring in the Annelida.

(1) "Annulata nova." Ofvers. of K. Vet-Akad. Förh, 1864.

Syllis corruscans. N. sp.

(Plate L., figs. 1—3; and LV., fig. 5.)

The colour of this large species is rich greenish-brown on the dorsal surface (after preservation in alcohol, sage green); red on the parapodia and the cirri, and reddish green on the under surface. There are two broad bands of emerald green on the first three segments, running obliquely backwards and outwards and narrowing posteriorly. The head and palpi are bright crimson.

The length is usually about $3\frac{1}{2}$ inches, the greatest breadth $\frac{1}{4}$ of an inch. There are 150 to 200 segments; on an average the segments are about four times as broad as long. In the anterior portion of the body the breadth of the segments is about seven times the length; towards the middle of the length of the body it is about five times, the breadth of the body decreasing and the length of the segments increasing at the same time. Each of the segments of the middle and posterior regions of the body is marked on the dorsal surface with several impressed transverse lines.

The head is short, twice as broad as long; the palpi are broad and somewhat dorso-ventrally compressed; they are continuous with one another for a short distance at the base, rather longer than the head, and are habitually directed downwards; the præstomial tentacles are subequal, the mesial very slightly longer than the lateral, a little longer than the palpi, obscurely ringed. The anterior pair of eyes are pyriform, with the apex directed inwards and slightly backwards. The hinder pair are rounded, situated behind and internal to the first, close to the posterior border of the head. There are two subequal peristomial tentacles which are much shorter than those of the præstomium, and, like them, indistinctly ringed. The dorsal cirri are longer than the tentacles, usually about equal in length to the breadth of the body (some being a little longer, some a little shorter), not very distinctly ringed. The number of joints varies from ten to twenty; in some instances a considerable

extent of the cirrus exhibits no joints. The parapodia are well developed, bilobed, the ventral lobe the broader, with about fifteen compound setæ, the dorsal lobe with six to eight stout, simple acicula. The ventral cirri are leaf-like and short, scarcely reaching as far as the extremity of the parapodia. The compound setæ are not distinguishable from those of *S. Schmardiana* described below. The anal cirri are rather stouter than the dorsal cirri immediately preceding them, as long as the last seven or eight segments, tipped with a small brown mark.

There is a single triangular tooth. The œsophagus in the retracted condition extends to the twelfth segment, the gizzard to the sixteenth.

This beautiful annelid is not uncommon in the littoral zone in Port Jackson, and is brought up very frequently in the dredge from various depths (up to 15 fathoms).

There are a good many points of resemblance between this species and *Syllis solida*, Grube, from the Phillipines: but in the latter species the palpi are relatively short, while the dorsal cirri are relatively long, and the transverse lines on the dorsal surface are apparently absent.

Characteristic of the hypoderm in this species (Plate LV., fig. 5) is the presence of innumerable multitudes of unicellular glands of flask-like form, with more or less prolonged necks, which pierce the cuticle to open by a minute pore on the exterior. Most of these glands are full of granular matter, which becomes intensely stained with hæmatoxylin; some of them, however, are occupied by an open reticulum. The ordinary hypoderm cells are arranged in an outer layer of vertically-elongated cells, the outer ends of which are broad, while the inner ends are drawn out into fine threads, and an inner layer of fibre-like cells which form a network of fine threads with nuclei and pigment granules.

The longitudinal muscular fibres of the body-wall form an almost continuous layer, interrupted only along the bases of the parapodia and along the line of the ventral nerve cord.

There is a circlet of about twenty compressed papillæ in the œsophagus. The tooth is hyaline, triangular, acutely pointed. The part of the lining membrane external to the papillæ is light red in the living state, that of the part following light pink. The cuticle of the œsophagus is extremely thick and hard, the epithelium composed of very narrow, fibre-like cells. The structure of the following division of the alimentary canal will be fully described by me elsewhere (1). It has usually been regarded as a glandular organ (Drüsenmagen, proventricule, stomach), but is really much more properly called a gizzard. It has a comparatively thin cuticle, like that of the outer surface, and an epithelium consisting of non-ciliated columnar cells, with conical and spindle-like "cellules de remplacement" at the base. The remainder of the thick wall of the organ is composed of muscular tissue—an external and an internal layer of the ordinary non-striated fibres arranged circularly and longitudinally, and a middle layer, which is by far the thickest, composed of striated fibres arranged in a radiating manner. There is, in addition, a set of non-striped fibres, which do not form a complete layer, but are disposed as a series of rings between the outer ends of the striated fibres. The wall of the organ presents on either side a raphe, where the striated fibres are absent and the layers of non-striated fibres blend. The striated fibres present a nucleated protoplasmic core, and the striations in their substance are of a very marked character. What are ordinarily described as the transverse rows of glands, are these rows of columns of striated muscle. They have been described and figured as glands by many observers, Claparède (2), Langerhans (3), and Ehlers (4) among the number; their muscular character, was observed by Eisig. (5), who, however, overlooked the striations.

(1) I have previously given the present species the temporary designation of *Syllis a*.

(2) "Annélides Chétopodes du Golfe de Naples."

(3) "Zur Wurmfauna von Madeira" and "Canarische Anneliden."

(4) "Die Borstenwürmer."

(5) "Ueber das Vorkommen eines Schwimmblasenähnlichen Organ bei Anneliden." Mittheil. aus der Zool. Stat. zu Neapel. II. Band.

There are two cæca in the succeeding part of the alimentary canal, each of which becomes branched, the branches themselves showing a tendency to divide. The epithelium differs from that of the gizzard in its much greater thickness, being composed of several layers of cells, of which the superficial layer is ciliated; the epithelium of the cæca is looser and more irregular, and the cilia appear to be absent.

The only other noteworthy point in the structure of the alimentary canal is the presence in the epithelium of the hinder portion of the intestine of multitudes of greenish concretions similar to those noticed by Claparède, in *Syllis gracilis*. Precisely similar bodies occur, often in large quantities, in the epithelium of the dorsal portion of the cæca of *Polynoë* and *Aphrodita*, and they occur also abundantly in the narrow glands of *Chloræma* and the so-called tubiparous glands of *Serpula* and *Sabella*. It is not unlikely that these concretions are in all these cases of a uric character, and that the organ in which they occur acts as the nephridium of the annelid. (1)

The nerve-fibres of the ventral cord are arranged in three distinct bundles, one smaller mesial, and two larger lateral. The large ganglion-cells are grouped on the dorsal aspect of the ganglia. Towards the middle line of the dorsal aspect of the cerebral ganglia, is a group of very large ganglion-cells arranged in converging lines enclosed in fibrous tissue, each group connected with the fibrous matter of the ganglia by bands of fibres. External to this, and nearly surrounding the whole of the fibrous matter of the ganglia, is a layer of very small cells which form specially large groups in the neighbourhood of the eyes.

The eye has a homogeneous crystalline lens, apparently formed of a thickening of the cuticle, a retina composed of short rod-like elements which do not stain readily with hæmatoxylin, and a layer

(1) It is necessary to draw a clear line of distinction between the terms "segmental organ" and "nephridium." Thus the nephridia of *Polynoë* are not the segmental organs, as Mr. A. G. Bourne maintains, but probably the dorsal division of the intestinal cæca, the segmental organs being generative ducts.

of columnar cells, which, thickly pigmented internally, are continuous externally with fibres passing into the substance of the cerebral ganglia.

The segmental organs are curved brown tubes opening on the ventral surface close to the parapodia. The function discharged by these organs in *Syllis* seems not to have been positively ascertained. No doubt they act as generative ducts, but neither Mecznikow, Ehlers, nor Claparède, who have all noticed or described the organs, mentions having observed them giving passage to ova or spermatozoa.

This species increases like many of the *Syllidæ*, by a combination of budding and fission; and exhibits some remarkable peculiarities in connection with the processes of reproduction. In specimens obtained from between tide-marks in Port Jackson, about the month of August, I found none in the act of proliferation; nearly all, however, showed a marked division of the body into two regions—a long dark-coloured female region, in which the body cavities of most of the segments contained ova, and a much shorter, posterior orange-coloured male region, in which the sexual glands were imperfectly developed testes. The passage from the one region to the other takes place somewhat abruptly about the 100th segment, the body at this point becoming narrower, and both the parapodia and the dorsal cirri smaller. In specimens taken at the same time in deeper water, the posterior orange-coloured region was found to be considerably longer; in most it had developed on its first segment two pairs of large eyes, and frequently was found altogether detached from the female. The following is a description of the curious male form thus produced by budding from the posterior end of the female :—

The colour is reddish orange, finely mottled with dark brown along the middle of the dorsal surface. The length is an inch, the breadth a fifth of an inch. There are forty-five segments, but some of the posterior segments appear to be wanting in the specimens I have examined. The head is very broad, broader than the body-segments, and very short; its anterior border is concave. In the middle of this concavity, on the ventral aspect, is a short ciliated process, and on

either side of this, just below and in front of the eye, is a broad lobe, which seems to represent a rudimentary palp. At the antero-external angle of the head is a short, horn-like tentacle. The eyes are just behind these tentacles, placed close to the lateral border of the head; their breadth is about a fifth of that of the head.

The first pair of parapodia are very well developed, and are nearly a fourth of the breadth of the head; they are furnished with about twenty setæ, all of which, except two or three on the dorsal aspect, are compound. Like the following segments, the first has a very long, ringed dorsal cirrus, which is very much longer than the breadth of the body. In the following segments the parapodia are very large and provided with two bundles of setæ, those of the dorsal fasciculus numerous, simple, very slender, and longer than the breadth of the segments; those of the ventral fasciculus compound.

The cavity of the body is full of bright red spermatozoa. The alimentary canal presents no trace of its ordinary divisions, having the form of a simple tube.

Syllis Kinbergiana. N. sp.

(Plate LI., Figs. 1-3.)

The colour of this species is light yellow, with greenish transverse lines. On each segment is a pair of very light yellow or greenish-white dots, which are most distinct in the middle and posterior regions of the body. There is a patch of white on the dorsal surface just behind the head. The head is light red, the eyes crimson. The ordinary length is $2\frac{1}{2}$ inches; the breath $\frac{1}{20}$th of an inch. The head is short, its breadth greater than its length, bilobed, the two halves rounded on the dorsal aspect. The palpi are triangular, rather pointed, twice the length of the head, separated from one another by a narrow interval. The median tentacle is twice the length of the palpi, a little longer than the lateral tentacles. The dorsal cirri are usually slightly longer than the breadth of the segment. Their joints are very indistinct and the number very irregular; usually there are about a dozen joints in

each cirrus, but the number varies with the length of the appendage. The segments of the body are, as as a general rule, about $2\frac{1}{2}$ times as broad as long; their lateral borders are strongly convex. Each of them is crossed on the dorsal surface, about its middle, by a narrow transverse impressed line, due to the presence in that position of a narrow transverse band of muscle. The parapodia are not prominent; they are bilobed, the lobes pointed; there is a stout ventral cirrus which is a little larger than the parapodium proper, with 15 to 25 compound setæ. On the dorsal side of those are three shorter acicula.

The œsophagus is surrounded by a circlet of papillæ and armed with a single triangular, hyaline tooth. When retracted the papillæ are opposite the third segment; the œsophagus, which is short, extends from the fourth to the eighth segments; the gizzard, which is also short, from the eighth to the eleventh.

There are two short cæca. The epithelium of the intestine is full of small, solid greenish granules.

The hypoderm is full of oval unicellular glands, sometimes quite clear, sometimes full of granules. All the specimens seen were males.

This species is not uncommon among mussels and ascidians on the shores of Port Jackson.

When compared with Grube's description of *S. umbricolor* one is struck by certain points of resemblance. Thus Grube describes his specimen as marked on the dorsal surface with grey transverse lines, and behind with impressed points, which might perhaps be the expression in spirit specimens of the markings described above; but the apparent absence of acicula and the smaller numbers of the setæ in the *S. umbricolor* seem to distinguish that species from the present one.

The present species is also nearly related to two European species—*S. gracilis* and *S. hamata*; but differs from both of them in the form of the setæ and the greater shortness of the gizzard; from the former also, apparently in the greater length of the cirri. It is likewise allied to *S. similima* of Claparède. From *S.*

bacillipara it differs, among other points, in the form of the unicellular glands (bacilliparous glands) of the hypoderm. Another near relative is *S. hyalina*, Grube (*S. macrocola*, Marenzeller) which, however, wants the very characteristic colouration and markings.

There is also some resemblance to *S. hexagonifera* of Claparéde ("Glanures," p. 73, pl. V., fig. 2), but, besides the differences in the markings, the present species has the palpi much shorter and stouter as well as more divergent, the cirri relatively thicker, the eyes larger and closer together, and the head broader in proportion to its length.

SYLLIS TÆNIÆFORMIS. N. sp.

Plate L., figs. 4 and 5.

The body of this species is long and flattened into the form of a ribbon; there are extremely long filiform cirri. The colour is light red, with numerous narrow transverse brown bands, and there are narrow bands of the same colour between the joints of the cirri and tentacles. The head is as long as broad, bilobed behind, with a nearly straight anterior border, and with the antero-lateral angles rather prominent. There are four large eyes; the anterior pair are circular, and placed close to the antero-lateral angles of the head; the posterior pair are reniform in outline, slightly larger than the anterior pair, and placed quite close to them and almost directly behind them, but very slightly on their inner side. The palpi are thick, as long as the head, strongly bent outwards in their ordinary position. The præstomial tentacles are long and very distinctly jointed; the middle one is four times the length of the head, the lateral one nearly equal to it. The peristomial tentacles and the dorsal cirri are similar, much longer than the breadth of the body, strongly ringed. There are two rather short, jointed anal cirri. The feet are uniramous, with three acicula, and about a dozen compound setæ; the latter have a short blade bifid at the apex. There is a short conical ventral cirrus about equal in length to the parapodia.

This very beautiful species is met with occasionally in trawling at depths of a few fathoms in Port Jackson. It is extremely fragile, and it is difficult to preserve specimens intact for examination. Though in general appearance unlike most species of *Syllis*, it presents, nevertheless, all the characters of that genus.

Syllis Schmardiana. N. sp.

Plate LI., figs. 4-8.

The colour of this small species is light reddish yellow; the eyes reddish brown. The dorsal surface is mottled with reddish brown, leaving on each segment three light spots, of which the outer pair sometimes have a dark dot in their centre. The length is $\frac{3}{4}$ths of an inch; the breadth $\frac{1}{50}$th of an inch. There are 75 segments. The body is broadest about the middle of its length, tapering towards each end. The proportion of the breadth of the segments to the length is on an average nearly as 4 to 1.

The head is prominent, rounded, a little broader than long; its dorsal surface has two rounded elevations on which the eyes are situated. The palpi are longer than the head, widely separated except close to the base. The anterior pair of eyes are very slightly larger than the posterior, rounded, situated nearer to the base of the lateral tentacles than to the posterior border of the head; the posterior pair are oval, with the long axis oblique, situated behind and internal to the larger pair. The median tentacle is about three times as long as the head, and consists of twenty-seven joints. It is inserted by a constricted base rather behind the posterior pair of eyes and close to the posterior border of the head. The lateral tentacles are very slightly shorter than the median and have twenty-five joints. They are attached immediately in front of the anterior pair of eyes. There are two pairs of peristomial tentacles—that situated nearest the dorsal side the longest, longer than the middle præstominal tentacle.

The parapodia are short, but divided into a neuropodial and a notopodial portion. The latter contains five or six stout, simple acicula, one or more of which may be obscurely bidentate at the

apex. The neuropodium contains ten to fifteen compound setæ similar to those of *S. nigropunctata* (vide *infra*), but more slender and with the terminal part much narrower in proportion, and three to five acicula. The ventral cirri are short and unjointed, scarcely projecting beyond the ends of the parapodia.

The dorsal cirri are very long, six times the length of the parapodia; as long as, or a little longer than, the breadth of the body, with about 35 to 40 very distinct and regular joints.

The œsophagus is long, extending back as far as the fifteenth segment. There is a circlet of about thirty papillæ and a conical yellow tooth. The gizzard is long and narrow, extending over eight segments. The glandular part of the alimentary canal is short, extending through two segments, and has two pairs of cæca, the anterior pair the larger and slightly branched.

This species is to be distinguished from *S. erythropsis*, Grube ("Annulata Semperiana," p. 121), to which it shows some points of resemblance, by the presence of the acicula and the greater number of setæ in the parapodia. From *S. vittata* Grube (*S. aurita* Claparède, *teste* Marenzeller), it is distinguished by the form of the setæ and the absence of the transverse violet lines.

The bases of the dorsal cirri are full of rounded bodies which are readily discharged by rupture.

The wall of the gizzard presents some 40 transverse rows of radiating muscle-columns, which, on a superficial view, shew a granular interior with reddish nuclei. Each of these columns has a square outer end where it fits in with its neighbours to produce the curious mosaic-like appearance presented by the wall of this part of the alimentary tube. The centre of the outer part of each column is occupied by a little clump of very granular protoplasm containing the reddish nuclei referred to above. The transverse striations are few (only some five or six in each muscle-cylinder) but very well marked.

The epithelium of the intestine in its whole length contains large numbers of greenish concretions similar to those found in the cæca of *Polynoe*, the nephridia of *Serpula*, and the paired glands of

Chloraema. In most species of *Syllis* these bodies are found only in the posterior regions of the intestine, in which position they were noticed by Claparède, in the case of *S. gracilis*.

All the three specimens which I have seen were females full of ova. The ovaries are situated laterally near the bases of the parapodia.

Syllis nigropunctata. N. sp.

Plate LII., figs. 1-3.

The length is $\frac{2}{10}$ths of an inch; the greatest breadth about $\frac{1}{20}$th of an inch. The ground colour is dull yellow; the dorsal surface of the segments is finely mottled with grey, which leaves on each segment two rounded spots of the ground colour, sometimes with a dark dot in the centre of each; at the sides of the segments are two and three black spots: towards the posterior extremity of the body these markings become much less conspicuous. The body is dorso-ventrally compressed. The number of segments is from 95 to 125. The head is rather broader than long, trilobed, the lateral lobes being very obscure, while the median one is large and rounded. The palpi are nearly twice as long as broad, rounded, widely divergent in the distal three-fourths, but closely approximated at the base. The median tentacle is about four times the length of the head, cylindrical, regularly ringed, with 22-25 joints inserted between the posterior pair of eyes, close to the posterior border of the head; the lateral tentacles are shorter than the median one, with 20 joints. The anterior pair of eyes are directed forwards upwards and outwards; they are situated a little behind the base of the lateral præstomial tentacles, and are of reniform outline; the posterior pair of eyes are situated behind and internal to the anterior pair, they are considerably smaller than the latter and are of circular form. The second segment is rather broader than the third. Its tentacles (peristomial tentacles) are two in number on each side, and much shorter than the tentacles of the head. The segments become broader from the anterior end of the body to the fifteenth segment and then very gradually become narrower towards the tail. The lateral borders of the segments are very strongly convex.

The parapodia are well developed except in the first few segments. Each has two prominent lobes. The ventral cirrus is rather shorter than the parapodia, not distinctly divided by joints; the dorsal cirrus is very long, as long as the body is broad, similar to the peristomial tentacles; moniliform at the extremities, with the joints (usually about 30 to 40) very distinct, except at the base. The dorsal cirri become very short towards the anal end of the body; the anal cirri are considerably larger than the dorsal cirri of the posterior segments of the body. The setæ, all compound, are about ten in number in each parapodium; the distal end of the shaft is very finely ciliate on one margin; the apical portion of the seta (blade) ends in two well-pronounced teeth and its border is ornamented with fine cilia. There are several stout aciculi, very slightly curved at the apex.

The œsophagus extends as far back as the seventeenth segment; it contains a single hyaline tooth and a circlet of papillæ. The gizzard extends over the following nine segments; the proventriculus over four segments; the cæca are two pairs, the anterior the larger. The intestine presents very deep inter-segmental constrictions.

The segmental organs are narrow brown tubes opening on the ventral aspect. The external orifice is a rounded opening situated at a point a little internal to the base of the ventral cirrus; from this point the tube runs inwards and backwards, then curves outwards to open by a wide aperture into the cavity of the segment. The tube is lined with somewhat irregular cells, having internal rounded ends, with the summits of which the long cilia are connected. It is very rare to find the cilia in active movement in specimens examined under the compressorium.

Found under stones between tide marks, at Neutral Bay, Port Jackson.

This species bears some likeness to *Syllis variegata*, Grube, but is much broader in proportion, has shorter tentacles and cirri, the palpi more divergent, and the head more pointed.

This species, like many of the family, increases by a process of budding and fission. About the 95th segment of the body in a

male specimen, having in all 125 segments, there is a sudden slight increase of the breadth, and the first of the broader segments bears two pairs of prominent brown eyes ; just behind the eyes, on the same segment, is a parapodium similar to those of the other segments.

In the hypoderm a peculiarity of this species is the arrangement of the glands. Instead of, as in *S. Kinbergiana* and *S. corruscans*, being simple, rather large, rounded or flask-shaped cells, they are very small and of irregular vermiculate shape, each opening by a minute tube piercing the cuticle.

Gnathosyllis zonata, N. sp.

(Plate LII,, figs. 4-6.)

The single specimen which I have seen contains fifty segments, but is incomplete—a considerable part, apparently, of the posterior portion of the body having been lost. The colour is light orange, with numerous narrow transverse purple bands, two on the dorsal surface of each segment, and very narrow purple rings on the cirri ; the head and palpi are bright orange.

The head is short and broad, the breadth about twice the length. The eyes in the specimen had their pigment arranged in a scattered, reticulate form, but I am not certain that this may not have been the result of *post mortem* change, as the specimen was dead when examined. The palpi are rather short, scarcely longer than the head. The median tentacle is about four times the length of the head, with well-marked joints ; the lateral tentacles are very little shorter than the mesial. There are two peristomial tentacles, the one about the length of the præstomial tentacles, the other longer. The segments are very short, very many times broader than long. There are about ten compound setæ in each parapodium on the ventral aspect, and on the dorsal four yellow acicula with very slightly curved apices. The dorsal cirri are mostly as long as the breadth of the body.

The œsophagus is lined with about twelve papillæ and a pair of simple jaws. When exserted this portion of the alimentary canal

extends as far back as the twelfth segment. The gizzard extends to the thirty-first segment: in structure it agrees with the gizzard of *Syllis*, but transverse striations were not observed in the radiating muscular fibres.

This species seems referable to Schmarda's genus *Gnathosyllis* ("Neue Wirbellose Thiere," I., ii., 69), but differs from the type species *(G. diplodonta)* in the form of the jaws, the much smaller size of the palpi, and many other points.

II. STAUROCEPHALUS.

Staurocephalus australis. N. sp.

(Plate LIII, figs. 1-5.)

The colour is light red. The body is nearly cylindrical, but a little compressed from above downwards There are nearly ninety segments, which are, on an average, eight to ten times as broad as long. The parapodia with their setæ are nearly equal in length to half the breadth of the body. The head is prominent, rounded in front; there are two pair of eyes of which the first pair are much the larger, reniform in outline, and placed far apart from one another towards the lateral borders of the head, while the hinder pair are circular in outline and situated internally to as well as behind the front pair. The superior pair of antennæ are attached just inside the larger pair of eyes, they consist of 11-13 joints and are twice the length of the head. The lower pair are slightly shorter, and have a long basal joint and a short oval distal one.

The parapodia are bilobate; the notopodium is armed with a number of fine, simple, tapering setæ, which are finely serrated along one side, and with one or two stouter setæ with a peculiar beak-like extremity; the neuropodium has about twenty compound setæ, with a slender, very slightly curved, terminal joint, obscurely notched at the apex and serrated internally. The dorsal cirri extend rather beyond the extremity of the parapodia; they are two-jointed, the terminal joint being small and pointed. The ventral cirri are very short, not extending beyond the extremity of the parapodia. There are two long anal appendages with a few

indistinct joints. There are two pairs of jaws; the anterior composed of two rows of teeth, of which those of the one set are short and stout with strong denticles, while those of the other are longer and narrower with a row of setiform denticles along one side. The jaws of the posterior pair are smaller; each consists of a single curved piece.

The hypoderm is full of rounded bacilliparous glands.

This species occurs between tide-marks on the shores of Port Jackson amongst mussels. It has some resemblance to *S. Chiaji* of Claparède, (1) but differs in the greater number of joints in the superior antennæ and in the form of the "avicular" setæ. The *Staurocephalus loveni* of Kinberg, (2) which was found in Port Jackson at a depth of twelve fathoms, differs from the above-described form in having the eyes small, and the second pair of antennæ twice as long as the first.

III. EULALIA.

Eulalia (Eumida) quadrocula. N. sp.

(Plate LIII., figs. 6-9.)

The length of this species is $10\frac{1}{2}$ inches; the greatest breadth, $\frac{3}{30}$ths of an inch. The colour is green, very dark on the dorsal surface, lighter underneath and on the parapodia.

The head is small, a little longer than broad, rounded in front. There is a median tentacle about half the length of the head, situated far back between the posterior pair of eyes, and two pairs of lateral tentacles about the same length as the median, placed near the front of the head; there are two pairs of eyes, the anterior pair situated near the front of the head at the base of the lateral tentacles, the posterior near the posterior border of the head, in both cases about half way between the mesial tentacle and the lateral border.

The first segment of the body bears one pair of tentacular cirri which are a little more than half the breadth of the body, stout at the base, pointed at the apex; the second segment bears two pairs

(1) "Ann. Chét. du Golfe de Naples," p. 115.
(2) Annulata nova, p. 574.

similar in form to the preceding pair, but the dorsal a little longer and narrower ; the third segment has one pair like those of the preceding segment, and a small ventral cirrus similar to those of the following segments, but no setæ.

The body contains about 270 segments, which are usually about three times as broad as long. The dorsal cirri are phylloid, a little broader towards the middle of the body than in front, the breadth about twice the length, the length not equal to half the breadth of the body, ovate, the free end gradually pointed. The parapodia are bilobed, with a phylloid ventral cirrus, armed with one stout brown aciculum, and about thirty compound setæ. The latter have a slightly expanded distal end produced into a beak-like process, with two or three short spines or teeth ; and a blade which is very delicate, curved and tapering, lined on its concave border with a row of very fine short cilia.

There is an exsertile proboscis, the epithelium of which is green and is produced into pyriform papillæ.

The species was obtained with the dredge in Port Jackson.

It is related to *E. microceros* of Claparède (1), but is distinguished from it by the presence of four eyes and by the dorsal cirri of the second and third segments not being prolonged and but little longer than the ventral.

IV. PSAMATHE.

Psamathe ? crinita. N. sp.

Plate LIII., figs. 10-12.)

The length of this species is three-quarters of an inch : the breadth an eighth of an inch. The colour is dull yellow, with narrow transverse bands of dark brown on each segment.

The head is squarish, with a single, very short median tentacle, and two lateral ones, the inner of which is situated at the antero-lateral angle of the head, and is about twice the length of the latter, while the outer is placed below the inner, and is about half its length ; both are slender and unjointed. There are two

(1) Op. cit., p. 247, pl. xvi., fig. 4.

pairs of large, rounded brown eyes, placed close together at the sides of the head, the anterior very slightly larger than the posterior. There seem to be eight peristomial tentacles—three shorter than the dorsal cirri, the rest of about the same length. There are thirty-six segments in the body, each, as a rule, about three-and-a-half times as broad as long. The parapodia are very prominent, being, with the setæ, nearly as long as the breadth of the body. They are deeply divided, the neuropodium being more prominent than the notopodium, and terminating in a slender pointed process: there is a stout aciculum, finely striated transversely, in each division, and a large number of tapering compound setæ, the basal parts of which are finely striated transversely, and the distal divisions bordered with fine cilia along one margin, and slightly hooked at the apex. There is a short central cirrus not so long as the parapodia. The dorsal cirri are very long, three or four times as long as the body is broad; they are not jointed, but are supported on a short ringed peduncle.

The eversible proboscis is lined with two or three transverse rows of club-shaped papillæ. There are no teeth. The gizzard is long; its walls are marked by narrow transverse lines, and are composed of transversely and longitudinally arranged non-striated muscle-fibres.

One specimen of the species was obtained with the dredge in Port Jackson.

It would appear to be more nearly related to *Psamathe* than to any other described form; probably, however, ought to be regarded as the type of a distinct genus.

IV. SIPHONOSTOMA.

Siphonostoma affine. N. sp.

(Plate LIV., figs. 1-5.)

The body is about an inch in length, and a tenth of an inch in greatest breadth: it is broadest in front, becoming narrower

behind, a decrease in breadth taking place suddenly at about the twentieth segment: the total number of the segments is about forty. The colour is light red; the hinder part crimson.

The head is broader than the immediately succeeding segments. Immediately in front of the mouth on the ventral surface are inserted a pair of thick longitudinally folded palpi which are three times the length of the branchiæ.

There are two pairs of eyes; the anterior pair are large, of subtriangular outline, placed close together one on either side of the middle line of the dorsal surface of the head. The second pair which are external to, as well as behind the first, are mere specks of black pigment. The head is surrounded by a circlet of about twenty-five short cylindrical green branchiæ, and external to those at the sides and behind, by two fan-like fasciculi of very slender setæ, about forty on each side; these extend nearly as far forward as the extremities of the palpi; they are simple and hair-like, but transversely jointed. The second and all the following segments have short parapodia armed with about half-a-dozen to a dozen slender setæ similar to those surrounding the head, and arranged in two fasciculi; on the ventral aspect of the parapodium is a dark-coloured, stouter, hook-like, seta considerably shorter than the others, likewise transversely jointed. The papillæ are numerous, frequently as long as the setæ, with a long and slender hyaline stalk and a head which varies in form, but is usually long oval or spindle-like.

The anterior larger pair of eyes are complex, with a thick, darkly pigmented choroidal capsule, lined internally by a thick retina, composed of elongated radially disposed cones: they are embedded in the substance of the cerebral ganglion.

Opening just behind the head on the dorsal surface near the lateral margin, are a pair of very long narrow cylindrical glands which extend throughout a considerable portion of the body. They have delicate walls and are filled with cells with colourless walls

containing in their interior rounded particles of some greenish matter.

Similar glands have been observed in *Chloræma* and in *Stylaroides;* they are regarded by Claparède as equivalent to the segmental organs of *Terebella* and *Amphicteis.*

This species, which is obtained with the trawl in Port Jackson, is apparently nearly related to *Siphonostoma diplochaitos*, Otto (*Chloræma Edwardsii* Quatrefages), but, besides the possession of four eyes, is distinguishable by the less strongly hooked ventral setæ.

V. HALLA.

Halla Australis. N. sp.

(Plate LIV., figs. 6 and 7, and Plate LV. figs. 1-4.)

The colour of this species is rich orange when first taken, but, on being kept for a few hours in an aquarium, it becomes stained particularly on the branchiæ, with dark purple. When the annelid is placed in alcohol a rich purple pigment is extracted. The length is from three to four inches, and the breadth from a fifteenth to an eighth of an inch. The number of segments is great, exceeding 200. The segments, on an average, are about four times as broad as long; the parapodia are prominent, their length being about a third of the breadth of the segment.

The head is uniformly rounded, a little longer than broad, twice the length of the peristomium, but rather narrower. There are three short, stout, conical, unringed tentacles, the middle one slightly larger than the lateral, scarcely half the length of the head. There are two pairs of eyes placed near the posterior boundary of the head. The anterior pair are larger than the posterior, oval, with the long axis directed inwards and forwards, widely separated; the posterior pair are much smaller, rounded, placed close together between the anterior pair and a little behind them.

The dorsal cirri (branchiæ) of the anterior segments are stout and short, but rather longer than the parapodia; towards the middle of the body they become much larger, compressed, leaf-like, about a third of the breadth of the body. The parapodia contain a bundle of about twelve slender, flexible, tapering setæ, feathered on one side near the apex, and towards the ventral side three shorter acute acicula.

There are seven pairs of jaws, the first, the largest, without teeth; the second small, slender, acutely pointed; the third with five teeth, three large and two small; the fourth with six teeth; the fifth with seven; the sixth with six or seven; the seventh very long, narrow, untoothed.

Specimens of this remarkable annelid are brought up, not unfrequently, with the dredge from depths of a few fathoms in Port Jackson. The genus has hitherto only contained one described species—the *Nereis parthenopeia* of Delle Chiaje (1), afterwards described under the name of *Halla* by Costa. Judging from Claparède's figures of *H. parthenopeia* in the "Annélides chétopodes du Golfe de Naples," the Australian species is to be distinguished from it by having the parapodia relatively more prominent, one of its lobes (the ventral one) being much longer than the other, and by the ventral cirrus being relatively shorter. The setæ of the European species also seem to want the long whip-like extremities.

The hypoderm consists of very irregular cells with internal fibre-like processes; and there are no glands. The alimentary canal is distinguishable into three regions—a short pharynx, a muscular dentary region, and a rather narrow intestinal region—without marked constrictions. The two first divisions are lined with columnar stratified epithelium without cilia. The epithelium of the intestine is composed of large irregular cells with clear contents and small nuclei.

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(1) "Memorie sulla storia e notomia degli animali senza vertebre," III. p. 164.

The eyes are rather complex in structure, like the eyes of many annelids, but have no lens, consisting of a thick-walled spheroidal capsule opening on the exterior ; the wall of the capsule is composed of a layer of pigmented cells continued internally into radiating elongated cones the bases of which are external, while the curved pointed apices line the central cavity. In complexity of structure the eye of *Halla*, though ranking higher than that of many Polychæta, yet falls considerably below that of such forms as *Tomopteris* (1) and *Alciope* (2) ; it bears a very strong resemblance to the eye of *Pecten* as described by Van Haren Roman (" Voyage of the *Willem Barents*," Die Lamellibranchiaten, p. 17.)

Embedded in the substance of the nerve cord in all the specimens I have examined, in the third to the eighth segments, are a series of eight or ten oval vesicles, $\frac{1}{165}$th of an inch in diameter. These are enclosed in a capsule of fine fibrous tissue with small nuclei, except at one point where a bundle of nerve fibres enters the interior. The capsule is filled with finely granular material, and contains a second smaller spherical vesicle, about a fourth of the size of the larger one. This smaller vesicle is more homogeneous than the larger one, and contains in its interior a spherical solid body, which stains darkly with hæmatoxylin. I have been unable to determine the nature of these bodies. In structure they have the appearance of very large cells with nuclei and nucleoli, and might be supposed to be encysted unicellular parasites, but the constancy of their presence, and, more particularly, the passage into their interior of a bundle of fibres from the nerve-cord, seem to point to their being essential parts of the animal : they may be a rudimentary form of otocyst.

(1) Vide Vejdovsky, "Beiträge zur Kenntniss der Tomopteriden" Zeitschr. f. wiss. Zool XXXI. Bd., p. 81.

(2) Greef, "Ueber die Augen insbesondere die Retina der Alciopiden," Sitzungsb. der Gesellsch. zur Beförderung der gesammten Naturwissenschaften zu Marburg, 1875, pp. 116-138.

EXPLANATION OF PLATES.

Plate L.

Fig. 1.—Head of *Syllis corruscans* from above, slightly compressed.
Fig. 2.—Extremity of everted proboscis.
Fig. 3.—Head of male.
Fig. 4.—Head of *Syllis tæniæformis* from above.
Fig. 5.—Compound seta of the same, × 210.

Plate LI.

Fig. 1.—Parapodium of *Syllis Kinbergiana* viewed from the dorsal aspect.
Fig. 2.—Tooth of the same.
Fig. 3.—Compound setæ.
Fig. 4.—Anterior portion of the body of *Syllis Schmardiana* from above.
Fig. 5.—Head of the same species from above, more highly magnified.
Fig. 6.—Head of the same from below.
Fig. 7.—Parapodium of the same.
Fig. 8.—Compound seta.

Plate LII.

Fig. 1.—*Syllis nigropunctata ;* head viewed from above.
Fig. 2.—Parapodium.
Fig. 3.—Compound seta.
Fig. 4.—*Gnathosyllis zonata ;* head viewed from above.
Fig. 5.—Jaws of the same.
Fig. 6.—Compound seta.

Plate LIII.

Fig. 1.—Head of *Staurocephalus australis.*
Fig. 2.—Teeth.
Fig. 3.—Parapodium.
Figs. 4 and 5.—Simple setæ.
Fig. 6.—Head of *Eulalia (Eumida) quadrocula.*
Fig. 7.—Parapodium of the same.
Fig. 8.—Compound seta.
Fig. 9.—Simple seta.
Fig. 10.—Head of *Psamathe (?) crinita.*

Fig. 11.—Parapodium of the same.
Fig. 12.—Compound seta of the same.

Plate LIV.

Fig. 1.—*Siphonostoma affine*, lateral view of head.
Fig. 2.—The same, ventral view of head.
Fig. 3.—Dorsal view of head shewing eyes.
Fig. 4.—Hooked seta.
Fig. 5.—Papilla.
Fig. 6.—Head of *Halla australis*.
Fig. 7.—Jaws of the same.

Plate LV.

Fig. 1.—Parapodium of *Halla australis*.
Fig. 2.—Vertical section of the mucous membrane of the œsophagus of *Halla australis*.
Fig. 3.—Vertical section of wall of intestine,
Fig. 4.—Otocyst (?) of the same, seen in section.
Fig. 5.—Vertical section of the hypoderm of *Syllis corruscans*.